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Review article

A brief review of the literature on the malignant ureteral obstruction

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Abstract

Malignant ureteral obstruction (MUO) caused by a primarily urological tumor or secondary to a late-stage malignancy can be difficult for the urologist to manage. Due to a lack of clinical data on the management of MUO, every case is particular and should be aborted individually.

Lack of specific treatment, either palliative or definitive, can severely damage renal function and lifetime expectancy in patients, causing even more damage that could otherwise be avoided.

Prompt management directed at the recovery of renal function is the main goal in such cases. Even after urinary flow is restored, life threatening post-obstructive diuresis needs to be managed.

Keywords : malignant obstruction, bilateral obstruction, unilateral obstruction, post obstructive diuresis, ureteral stent, percutaneous nephrostomy

Highlights

- ✓ Malignant obstruction is a life-threatening pathology that requires prompt management for an optimal renal function.
- ✓ Nephrostomy remains the only method that can reduce the external compressive obstruction with a rate of nearly 100%, but other methods should be considered.

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Introduction

Malignant ureteral obstruction (MUO) is a commonly encountered problem in late-stage gynecologic malignancies. However, numerous other malignant pathologies can also lead to ureteral obstruction either by nearby compression such as retroperitoneal tumors (1, 2), or by their direct invasion like that encountered in bladder tumors or malignant prostatic hyperplasia (3, 4). Often these patients develop urinary stasis and ureterohydronephrosis and they will evolve towards chronic kidney disease (5, 6). For patients with obstructive chronic kidney disease, urinary drainage may restore normal kidney function, but in some cases it may prove to be ineffective, these patients requiring hemodialysis (7, 8). Diabetes mellitus and other pathologies that associate immunodeficiency significantly increase the risk of urinary sepsis in patients with slowly progressing undiagnosed urinary retention (9, 10). These patients can present at the emergency department with a general altered state, complaining of pain, fever, chills, confusion, or obnubilation (encephalopathy secondary to the growth of nitrate retention products), with acute renal failure and ureterohydronephrosis (11). Other signs of septic shock usually found in such cases are: hypertension as well as hypotension (12, 13), tachyarrhytmias (as a result of the hydroelectrolytic imbalance) and heart failure (14, 15), disseminated intravascular coagulation, and venous thromboembolism (16). Therefore, special attention should be given to this type of patient. Prompt management is necessary for prevention or treatment of renal dysfunction and infection secondary to prolonged obstruction (17).

Drainage with ureteral stents seems to be the first-line therapy to relieve an obstruction caused by a malignant growing. The evolution of the design and materials of ureteral stents has dramatically changed throughout medical history, from the polyethylene tubes that were developed—thanks to the discovery of plastics—to bridge the gap in a cut ureteral using an animal model (18), to the modern double-J stent and the single-pigtail stent first introduced by Finney and colleagues (19). In a 10-year prospective study, ureteral stent caused varying degrees of discomfort to patients. However, none of the materials (4 types) used proved superior in terms of secondary manifestations for this foreign body in the urinary tract (20).

Nephrostomy represents another alternative for palliative treatment of MUO. Nephrostomy is a minimally invasive treatment for urinary obstruction with a marked hydronephrosis that creates an opening between the kidney and the skin, creating a diversion directly from the upper part of the urinary system (21).

However, the median life expectancy in the patients with metastatic cancer that causes ureteral obstruction is generally under one year (22).

Discussions

This paper presents a brief review of the prevalence, etiology, pathophysiology, clinical presentation, diagnosis methods, and various treatments of MUO.

Prevalence

A good marker suggestive of obstruction is represented by hydronephrosis. A total of 59,064 autopsies with an age ranging from neonates to geriatric subjects reported an incidence in the general population to be 3.1% (23). The actual overall incidence of the ureteral obstruction due to malignancies is unknown, but clinically it is frequently encountered as a progressive pathology, leading to urinary blockage and presenting a risk of renal functional decline (24).

Regarding etiology, only 21% of patients have MUO caused by a primary urological tumor (25). Generally, the ureteral obstruction can be the consequence of a direct tumor invasion, extrinsic ureteral compression, encasement by retroperitoneal lymph, or retroperitoneal fibrosis.

Pathophysiology

The main variables that change in MUO are: glomerular filtration rate (GFR), renal blood flow (RBF), and ureteral pressure (UP). The pattern of changes among these variables is defined by the three phases, and is different for unilateral obstruction vs. bilateral obstruction (26).

Unilateral obstruction. Animal experiments on unilateral obstruction have shown a triphasic pattern that differs from bilateral obstruction:

- 1st phase (1-2h after obstruction): RBF- increases, high hydraulic pressure of fluid in the tubes, and high pressure in the collecting system (UP).
- 2nd phase (3-4h after obstruction): RBF- decreases, UP- continues to increase.
- 3rd phase (5h after obstruction): both RBF and UP decrease (27).

GFR is maintained in 1st phase (the main reason being an increase in RBF), while in the second and third phase GFR decreases (28).

Bilateral obstruction. Changes related to bilateral obstruction are different than unilateral obstruction (26). In the first 90 minutes after obstruction, the RBF increases, then slowly begins to decrease, UP increases

and remains elevated for a longer time than in unilateral obstruction (29).

Post obstructive phase. Post obstructive phase is commonly encountered in bilateral obstruction; however, it is sometimes also seen in unilateral obstruction (30). MUO causes an immense retention of sodium, urea, water, and many other osmolar substances, able to lead to a profound diuresis afterwards (31).

Clinical presentation

Lower Urinary Tract Obstruction (LUTO) may be caused by benign processes such as benign prostatic hyperplasia (BPH), prostatic cystadenoma, or malignant tumors such as the bladder invasion distal to the trigone. LUTO can manifest as voiding dysfunction such as urgency, frequency, nocturia, incontinence, decreased stream, hesitancy, post void dribbling, and a sensation of inadequate emptying. Suprapubic pain or a palpable bladder indicates urinary retention. Infection may be present, and patients may experience dysuria (32-34).

Acute Upper Urinary Tract Obstruction. Pelvic obstruction secondary to malignancies can be the consequence of stricture formation from recent surgery, or due to radiation induced strictures (35, 36). Acute upper urinary tract obstruction manifests differently, as dull, sharp, or colicky, intermittent or persistent pain, often radiating to iliac fossa. Nausea and vomiting are commonly associated with acute obstruction. Anuria suggests bilateral complete obstruction (37).

Chronical Upper Urinary Tract Obstruction. Such obstructions are usually caused by an extrinsic tumor, or retroperitoneal fibrosis (38). Chronical upper urinary tract obstruction has a vague set of symptoms, usually flank discomfort, feelings of fullness, or nonspecific lethargy; sometimes this condition can be masked by urinary tract infections (24).

Evaluation

After performing anamnesis, physical examination, and obtaining basic serum analysis (e.g. electrolytes), imaging investigations are further considered for renal function assessment, as presented below.

Ultrasonography. Renal ultrasonography can be considered as a first line intent in detecting the hydronephrosis. It is inexpensive, widely available, does not produce radiation, and can be used safely in pediatric patients and pregnant woman (39). Grey scale ultrasound has a reported sensitivity of 98% to determine the hydronephrosis (40). However, ultrasonography can only determine the anatomic dilatation of the urinary tract and not any functional obstruction (31). The Doppler mode can be used to identify the urine ejection at the bladder level (41).

Nuclear medicine renography. Radioisotope renography is a form of imaging that uses radio labeling to determine renal functioning (42). The two most common radiolabeled pharmaceutical agents are Tc99m-MAG3 and Tc99m-DTPA (diethylene-triamine-pentaacetate). Other radiolabeled pharmaceuticals are EC (Ethylenedicysteine) and 131-iodine labelled OIH (ortho-iodohippurate) (43). Tc99m-MAG3 and Tc99m-DTPA are freely filtered and only eliminated by the proximal tubes. The halftime of these agents is used to evaluate the renal function: A halftime under 10 minutes is normal, while a halftime over 20 minutes is an indication of an obstruction (39).

Computed Tomography and Magnetic Resonance Imaging. Computed tomography (CT) and magnetic resonance imaging (MRI) are increasingly valuable tools for assessing the urinary tract in adults and children. Modern CT scanners are fast and can scan the abdomen and pelvis typically in 5–7 seconds once the planning view (the ‘scout’ or ‘scanogram’) has been set up (44). Unenhanced helical CT diagnoses the ureteral stone disease with 95% sensitivity, 98% specificity, and 97% accuracy (45). A CT urography scan can visualize the renal system in 3 phases: non-contrast, nephrogenic, and excretory (46). As a result, it can determinate stones and calcifications in non-contrast phase and determinate filling defect in excretory phase. It can also show extrinsic anatomic abnormalities (39). MRI provides similar anatomic information as a CT-scan. Because it does not produce ionizing radiation, it is safer in children and pregnant women.

Urodynamics. Urodynamic investigation is a functional assessment of the lower urinary tract to provide objective pathophysiological explanation for symptoms and/or dysfunction of the lower and upper urinary tracts (47).

Treatment

Even after a complete resolution of pelvic malignancy, patients can still develop obstructive uropathy, not only from the disease, but from the treatment itself. Patients can develop many issues after surgical management, chemotherapy, and radiation treatment (35, 38, 48). The treatment of malignant uropathy varies for every particular case and depends substantially on the etiology of the uropathy. It may range from a definitive curative option to a palliative one.

Lower urinary tract obstruction. The main goal of lower urinary tract obstruction is bypassing the obstruction with a catheter. Initially, a Foley catheter can be used; if this is inefficient or the obstruction cannot be bypassed, a suprapubic tube should be considered. After the urinary flow is obtained through a bypass, the goal changes, being focused on recovering from the electrolyte abnormalities. At this point, the acute phase is resolved and definite management should be considered (31).

Upper urinary tract obstruction implies ureteral stent or nephrostomy. Ureteral stents can be used as a long-term measure in patients with MUO (49), but the result depends on the etiology of the obstruction (50). In extrinsic etiologies, the stent tends to fail more frequently (51). The main goal of a stent is to create an optimal urinal flow, with minimal irritability (52). The latest metallic stents show promising results, insofar as overwhelming the extrinsic compressive forces. Another benefit of such stents is that it requires less frequent changing (49, 53). However, an ideal stent has not yet been invented, and current stents are not without morbidity. The most frequent side effects are: urinary frequency and urgency, dysuria, hematuria, and lumbar pain (20). Long term stenting seems to damage the ureterovesical junction; as a consequence, the junction will lose its tonicity and the ability for unidirectional flow of the urine, which can cause a recurrent reflux and pyelonephritis (54).

Regarding nephrostomy, the research literature shows that the indication for nephrostomy is in 60% of cases due to malignant obstruction (55). It remains the only method that can reduce the external compressive obstruction, with a successful rate nearly of 100%, vs. 50% for ureteral stents (56).

Conclusions

Malignant ureteral obstruction remains a major health problem that affects all categories of people around the world. Prompt diagnosis and treatment should be made to maintain optimal renal function. Even though there are numerous possibilities for the management of MUO (56), ureteral stenting and percutaneous nephrostomy are most widely used.

Ureteral stenting appears to be the first line intent in most of cases (even though it presents a great chance of failing), especially in that the development of metal ureteral stents and other combinations shows promising results. The lack of randomized clinical data to compare the effectiveness and safety of the several procedures performed currently puts the physician in a decision-making situation for every individual case, while the patient should be educated and integrally involved in the decision-making process.

Conflict of interest disclosure

The authors declare that there are no conflicts of interest to be disclosed for this article.

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